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AFRL technologies guide, power Mars rovers

Engineers from the Air Force Research Laboratory have designed the computer that steered Mars Explorer Rover Spirit to a safe landing on Jan. 4. An additional technology, a battery co-developed by AFRL, will power Spirit and a second rover, Opportunity – scheduled to land Jan. 25-, during their exploration of Mars terrain. AFRL's Space Vehicles Directorate designed the radiation-resistant computer, Rad 6000, which controlled the spacecraft during its flight from Earth. Lightweight, high-power, lithium ion rechargeable batteries, a joint project by AFRL, NASA Glenn Research Center in Cleveland and the Jet Propulsion Laboratory in Pasadena, Calif., will run the rovers a few hours after landing. The batteries will provide power at night, while solar panels recharge the batteries during the day. (Courtesy photo)

News Brief

Library to convert to contractor operation

KIRTLAND AIR FORCE BASE, N.M. — The Air Force Research Laboratory's Technical Library is changing from a government-run to contractor-operated facility, Air Force officials announced last month.

This change, which was mandated by the Office of Management and Budget, is not expected to impact any of the services now available to library customers. The conversion is expected to be complete by October 2004.

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Rome engineers participate in lecture series

by Fran Crum, Information Directorate

ROME, N.Y. — Engineers Dr. Gerard T. Capraro, Dr. Michael C. Wicks, and John F. Spina recently participated in a NATO Lecture Series on "Knowledge-Based Radar Signal & Data Processing". The series was conducted Nov. 3-11 in Linkoping, Sweden; Rome, Italy; and Budapest, Hungary.

The series was proposed and sponsored by the Sensors & Electronic Technology Panel, one of six NATO Research and Technology Agency panels.

Spina, assigned to the Air Force Research Laboratory's Sensors Directorate at Rome, served as lecture series director, while Dr. Wicks, also of the Sensors Directorate, presented two lectures on knowledge-based applications for Space Time Adaptive Processing and Constant False Alarm Rate processing.

Dr. Capraro, of Capraro Technologies, Inc., Utica, presented lectures on the fundamentals of knowledge-based techniques and integrated end-to-end radar signal & data processing with over-arching knowledge-based control. Other lecturers included Dr. Alfonso Farina, Alenia Marconi Systems, Rome, Italy; and Dr. Hugh Griffiths, University College, London.

The goal of the lecture series was to present a state-of-the-art assessment of knowledge-based radar signal and data processing techniques, and thereby increase awareness of their value to the NATO scientific community. The symposiums reviewed the current developments in the area and presented examples of improved radar performance for augmented and upgraded systems, and projected the impact of knowledge-based technology on future systems.

More than 100 participants from six NATO and Partners-For-Peace countries attended the series. As a result of the interest, the lecture series team has been asked by NATO to do a repeat performance in Poland this year.

The organization of Lecture Series forms part of the NATO Research & Technology Agency Consultant and Exchange program, which coordinates the overall lecture series program and assigns the presentation to the various nations involved in conjunction with the panels and the national authorities. @

Additional newsletter stories online at

http://www.afrl.af.mil/news/index.htm

AFRL conducts thermal testing on real B-2 airframe

by Melissa Withrow, Air Vehicles Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Recent thermal testing on a B-2 ground test airframe will save the Air Force lots of time and hundreds of thousands of dollars.

The Air Force Research Laboratory's Air Vehicles Directorate, with support from the Air Force Museum, was able to conduct thermal testing on the air frame. The museum possessed the airframe for restoration and public display.

This opportunity came at an integral time during VA's research on how high temperatures affect structures. Testing could have been completed using a generic model, but it was beneficial to have a real B-2 aft deck with structural cracking.

From conception to completion, the effort took six months. "That's an extremely short period of time to get something like this done," says Maj. Robert Mann, Chief of the B-2 Systems Program Office (SPO) Systems Branch. "An opportunity presented itself that we were able to seize and save a ton of money by using that test article. The traditional way to do this would have easily cost us a year."

B-2 aft deck structural cracking is not a safety of flight concern but requires extra maintenance time and expensive repairs. Dr. Kristina Langer and Dr. Mark Haney, VA aerospace engineers, have traced the problem to thermal buckling or structural expansion and contraction caused by extreme changes in temperature from engine exhaust. Unlike other airplanes, the B-2's engines are inside its wings. Engine exhaust travels over the aft deck subjecting it to high temperatures.

Original B-2 development models considered the effects of this engine placement, but at that time, engineers lacked experience with low observable structures and used hand calculations to evaluate the model's accuracy. Today, technology like the Major Shared Resource Center, with over 3,000 processors, is available to correctly capture the complexities of this design. Langer and Haney are applying the test results to VA's research to create more accurate B-2 models, which will be used to study potential aft deck re-designs that are more durable.

Sean Coghlan, lead engineer for the experiment, worked with museum personnel for several months preparing for the tests and coordinating testing with restoration work.

"Because this aircraft doesn't have engines in it, we had to simulate the heat on the aft deck with heat lamps." Coghlan's team used tungsten filament quartz heat lamps to heat the aft deck structure to jet engine exhaust temperatures. The testing required long hours, including weekends and overtime, to be completed before the B-2, "Spirit of Freedom" was scheduled for display at the museum.

Data from the testing is still being analyzed, but already, previously unknown effects are being discovered, which will make the new models more accurate. @

AFRL demonstrates life extending benefits of C-130 patch

by Melissa Withrow, Air Vehicles Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — The Air Vehicles Directorate (VA) worked with the North Carolina Air National Guard to demonstrate a life extending structural damping patch on an operational C-130.

The patch, created and installed by Damping Technologies, Inc., was made out of layers of aluminum and a viscoelastic material. For the demonstration, the patch was attached to a panel behind one of the C-130's engines. The directorate chose this panel because of its frequent cracking rate; it has required repair in approximately half of NCANG's C-130 fleet.

Before the demonstration, the Air Vehicles Directorate collected vibration and temperature data on the designated panel during five flights using an Air Force Research Laboratory-developed data acquisition system called the Damage Dosimeter. After the patch was applied, the directorate collected vibration and temperature data for seven additional flights. When engineers compared data from these two sets of flights, they found the patch decreased strain on the panel, indicating this patch could increase the life of the panel by 4.6 times.

VA plans to keep the patch on the C-130 for the remainder of its life for continual evaluation. Use of this patch has the potential to stop delays in development of fatigue cracking, which will decrease repair costs and increase operational readiness.

C-130 Durability Patch

Fatigue cracking caused by vibration is common on most aging aircraft. Vibration is caused by energy being put into the aircraft panel through various sources, such as from turbulent airflow, high acoustic levels, or engine vibrations transmitted through the structure. A damping patch absorbs this vibrational energy, which decreases the amount the panel bends during each flight. @

AFRL, Univ. of New Mexico join forces to provide research opportunities

by J. Rich Garcia, Directed Energy Directorate

KIRTLAND AIR FORCE BASE, N.M. — Improving chemical lasers is just one of the expected outcomes from a collaboration between the University of New Mexico and the Air Force Research Laboratory.

Providing research opportunities for graduate students and developing a pipeline for future laser scientists are other outcomes expected from a three-year Cooperative Research and Development Agreement that was signed Dec. 9 by the laboratory's Directed Energy Directorate and the Albuquerque-based university.

Research will be performed at the directorate's Chemical Laser Facility using directorate scientists working with university professors and graduate students. Their research will focus on how chemicals flow within a laser system and how those chemicals are mixed in subsonic and supersonic nozzles and interact with each other.

Chemical lasers include the Chemical Oxygen Iodine Laser and All Gas-Phase Iodine Laser. Both were invented by Directed Energy scientists. Also included are the Hydrogen Fluoride Laser, Deuterium Fluoride Laser and high-speed flow discharge lasers, all of which use the interaction of various chemicals to produce an action and/or reaction that generates laser light. Researchers will be observing, measuring and testing these chemical flows and their mixing, with results expected to improve the operation of all these lasers.

For this research, the directorate will be using some of its world-class capabilities, including a $250,000, one-of-a-kind, planar laser-induced fluorescence – an instrument that looks at chemicals as they are combined. It is used to tell how well chemical mixing nozzles are working.

According to Dr. Gordon Hager, technical advisor for the directorate's Chemical Laser Branch and the individual overseeing this agreement, "We all gain from the arrangement. Not only does the technology advance but this opens the door for the university to gain additional federal research monies. It will also provide a training ground that will help turn students into future scientists in a technology area that doesn't often offer students this kind of an opportunity." @

Forgotten funds net AF $2M

by Fran Crum, Information Directorate

ROME, N.Y. — A procurement analyst at the Air Force Research Laboratory's Information Directorate, uncovered hidden funds that has already netted the Air Force more than $2 million and is expected to save more than $10 million over a five-year period.

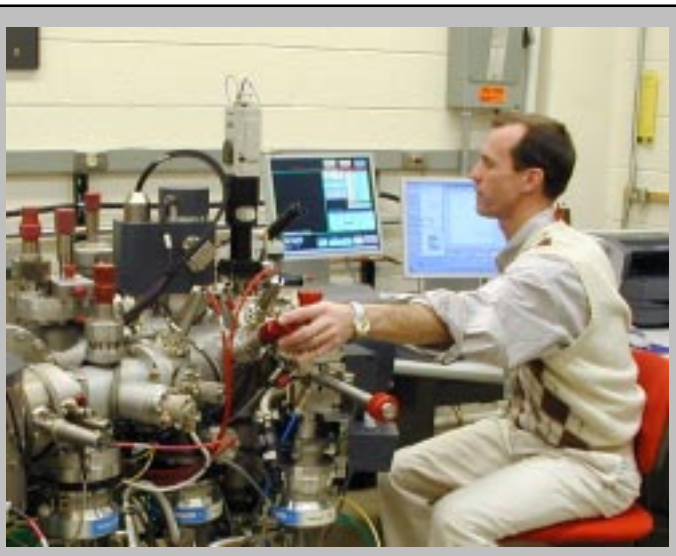
Susan Hluska's submission to the Air Force Innovative Development through Employee Awareness (IDEA) program earned her a $10,000 award.

The suggestion focused on accounts under the Government Purchase Card (GPC) program — credit cards used for purchases under $2,500 in support of the directorate's research and development projects. Many of these accounts were stopped at the end of a fiscal year because of lack of funding, and a new GPC account opened with subsequent fiscal year funding. After the account was terminated, vendor refunds, bank rebates, and other credits were posted to the inactive accounts.

"It was purely by accident that I spotted it buried in a report generated by USBank," said Hluska, of funds being held by USBank in hundreds of inactive accounts. "The bank was reporting quarterly credits to Air Force GPC Agency Program Coordinators for credits applied to active accounts; however, it was not automatically refunding these credit balances on inactive accounts. Some of the credits had been there for years."

"Information that money was sitting there was well documented, but it was not information the bank gave out freely," said Hluska, a 23-year federal employee who joined the laboratory staff with the realignment of Griffiss Air Force Base in 1995. "If the credit balance came at the end of a fiscal year, it was never rebated and the funds sat inactive."

Implementation of Hluska's suggestion recouped at least $20,000 during fiscal year 2003 for the AFRL GPC Program, and more than $2 million Air Force-wide. The Air Force has about 48,000 GPC accounts. @



New system tests material surfaces

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Dr. Howard Smith fine-tunes the newly acquired Secondary Ion Mass Spectrometry analysis system used to identify and quantify materials in semiconductors, aircraft corrosion and oxidation samples, and thin films. Dr. Smith is a scientist with the Materials and Manufacturing Directorate. The system is capable of analyzing materials surfaces and depth composition with sensitivities as high as parts per billion. A ribbon cutting ceremony for the new system was held Dec. 12 at ML's Survivability and Sensor Materials Division. (Air Force photo by Rae Parks)

IF's Research Facility wins AFMC Concept Design award

by Fran Crumb, Information Directorate

ROME, N.Y. — The Air Force Research Laboratory Information Directorate Research Facility has been chosen for the Honor Award in the Concept Design Category in the 2004 Air Force Materiel Command Design Awards.

The award is the highest presented by the command in a program intended to promote quality design. The program encourages award-winning efforts by recognizing individual designers and architect-engineering firms who display a high level of creativity while producing cost-efficient, energy-conscious facilities compatible to their environment and meeting user needs and expectations.

Atkins Benham Constructors of Oklahoma City, Okla., was awarded a $19,698,968 contract in September 2001, for construction of the facility through a cooperative effort between the Air Force and New York State's Empire State Development Corp. at the Griffiss Business & Technology Park. The new, 105,000-square-foot facility will house more than 300 government employees and contractors. When fully occupied next year, the AFRL Information Directorate Research Facility will consolidate the directorate's technical divisions into a single complex, including an adjacent existing building. This consolidation will enhance collaboration among the directorate's scientists and engineers and provide the most current state-of-the-art research environment.

The Naval Facilities Engineering Command, Philadelphia, Pa., was responsible for administering the construction. The facility is the centerpiece of a $24.8 million program that also included changes to the existing adjacent building and site enhancements. @

Sensors Director recognized for technical leadership

by Grace Janiszewski, Sensors Directorate

Dr. Donald W. Hanson

WRIGHT-PATTERSON AIR FORCE BASE, Ohio —The Director of the Air Force Research Laboratory's Sensors Directorate has been elected a Fellow of the Institute of Electrical and Electronic Engineers.

Dr. Donald W. Hanson was recognized for his technical leadership in the development and realization of sensors, science and technology.

"I am honored to receive this recognition," Hanson said. "I am flattered to join the very elite group of electrical and electronic engineers who are Fellows of the IEEE."

As SN Director, Dr. Hanson oversees an annual budget of more than $400 million, and directs the activities of more than 1,100 civilian, military, and contractor personnel at three separate geographic locations.

He is responsible for planning, directing, and evaluating sensor and countermeasures science and technology programs, requiring extensive coordination with other federal agencies, industry, private research organizations, and foreign governments.

Dr. Hanson serves as the Air Force principal for the Department of Defense (DoD) Sensors, Electronics, and Electronic Warfare Panel, coordinating all DoD activities within these areas with peers from the Army and Navy. He is a member of the Senior Executive Service.

In addition to his accomplishments as a technical manager, Dr. Hanson was a pioneer in the development of adaptive optical systems that compensate for aberrations incurred when optical signals propagate through the atmosphere. Dr. Hanson has published numerous papers and articles and holds two patents. @

VA Information Officer earns Exceptional Achievement Award

by Melissa Witihrow, Air Vehicles Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Clare Paul, Air Force Research Laboratory's Air Vehicles Directorate, recently received NASA's Exceptional Achievement Medal. Paul, VA's chief information officer, was honored for his "exceptional service and dedication in support of the Columbia Accident Investigation Board during a period of national tragedy".

Signed by NASA Administrator, Sean O'Keefe, this honor is one of NASA's most prestigious honor awards presented for outstanding contributions to NASA's mission.

The investigation board requested Paul's assistance for the experience he gained as lead engineer in the office that oversees research and development investment for the Air Force's aging aircraft fleet.

Paul says being a part of the investigation was a "great experience for all the wrong reasons". Columbia's accident on February 1, 2003 was tragic, but it allowed him to work with many "extraordinary" people—leaders in their fields of safety, science, engineering, and management. The board included 12 members and was aided by over 50 subject matter experts. Of the participants, only 10 received the Exceptional Achievement Medal.

Paul was one of three engineers in the Management and Treatment of Materials Group. They evaluated Columbia's material condition, including the external tank foam, reinforced carbon-carbon wing leading edge, and the heat resistant tile. Their findings, along with those of the other experts, were incorporated into a series of reports that identified the probable cause of the mishap and made recommendations for shuttle program improvements. @

Net Index

Due to the number of submissions we receive, some sections of *news@afrl* are available exclusively on-line. The on-line version of the newsletter allows users to view the AFRL corporate calendar, news releases generated by AFRL headquarters, operating instructions, L@b L@urels and Roundups sections.

The L@b L@urels section of the electronic newsletter is dedicated to members of Air Force Research Laboratory who receive awards and honors. The Roundups section of the electronic newsletter keeps Air Force Research Laboratory employees informed about contracts AFRL has awarded. Below is an index of articles one can find in each of these on-line sections.

Information Directorate awards $1.1M contract to Boeing

by Fran Crumb, Information Directorate

ROME, N.Y. — The Air Force Research Laboratory's Information Directorate has awarded a $1,195,010 contract to The Boeing Co. of Seattle, Wash.

The six-month agreement, "Clockless Logic Analysis, Synthesis and Systems (CLASS)," is funded by the Defense Advanced Research Projects Agency (DARPA) of Arlington, Va., under its Design Tools for Integrated Asynchronous Electronic Circuits program.

The emphasis of the CLASS program is on the development of asynchronous digital logic integrated circuit design techniques that overcome issues with the dominant synchronous (clocked) design methodology.

Under this program, an evaluation and design environment infrastructure will be developed and used to demonstrate advantages of asynchronous logic implementations to achieve drastically reduced design effort, improved energy utilization, reduced electromagnetic interference, and increased robustness (voltage and process variation) compared to corresponding clocked designs. The ultimate purpose of the CLASS program is to enable the rapid design of highly complex, asynchronous System-on-a-Chip devices that would not be practical with the traditional, full-custom, synchronous circuit design approach, especially in the coming sub-100nm domain.

The Boeing award is for the first phase of a three-phase research program. Subsequent awards could increase the value of the contract to more than $10 million.

Clockless chips have already been demonstrated for high-performance applications with significantly reduced power consumption. Despite these prototype demonstrations, asynchronous architectures have not found wide acceptance in the electronics industry due to the lack of an infrastructure to design, test and fabricate asynchronous chips in a reliable, efficient and economical way.

The lack of commercially supported CAD tools for asynchronous design has been a significant barrier in developing clockless chips and DARPA is pursuing the feasibility of developing a new generation of those tools to spur development of the technology. @

Just one of February's News @ AFRL feature stories

KIRTLAND AIR FORCE BASE, N.M. – The nose of an old 747, rescued from a salvage yard, protrudes through the exterior wall of the Airborne Laser's (ABL) System Integration Laboratory at Edwards Air Force Base, Calif. ABL engineers are using the hulk as a platform to build and test the Chemical Oxygen Iodine Laser (COIL), the system that produces the megawatt-class beam needed to destroy a ballistic missile. In the background is another ABL facility, the Ground Pressure Recovery Assembly, a hollow sphere needed to emulate an altitude of 40,000 feet so the COIL can be tested at ABL's nominal operational altitude. (Air Force photo)